Volume 8 1994

AAINEH ISSN: O883-9514

APPLIED ARTIFICIAL INTELLIGENCE

AN INTERNATIONAL JOURNAL





EDITOR-IN-CHIEF: Robert Trappl

Austrian Research Institute for Artificial Intelligence and University of Vienna

EDITORIAL ASSISTANT: Gerda Helscher

ASSOCIATE EDITORS:

Ronald Brachman AT&T Bell Laboratories, Murray Hill, NJ, USA

Rodney A. Brooks Artificial Intelligence Laboratory, MIT, Cambridge, MA, USA

Hiroaki Kitano Sony Computer Science Laboratory, Tokyo, Japan

Douglas B. Lenat Microelectronics and Computer Technology Corp., Austin, TX, USA
Oliviero Stock IRST, Trento, Italy

Wolfgang Wahlster University of the Saarland, Saarbruecken, Germany

EDITORIAL BOARD:

Luigia Carlucci Aiello, University of Rome, Italy; Leonard Bolc, Polish Academy of Sciences, Warsaw, Poland; Ernst Buchberger, University of Vienna, Austria; Stefano Cerri, University of Milan, Italy; Helder Coelho, Technical University of Lisbon, Portugal; Marie-Odile Cordier, IRISA, University of Rennes. France: Françoise Fogelman-Soulie, Université Paris-Sud, Orsay, France; Les Gasser, University of Southern California, Los Angeles, CA, USA; Karamjit S. Gill, University of Brighton, UK; Eva Hajicova, Charles University, Prague, Czech Republic; Otthein Herzog, IBM Deutschland, Stuttgart, Germany; Werner Horn, University of Vienna, Austria; Yves Kodratoff, CNRS & Université Paris-Sud, Orsay, France; Robert Milne, Intelligent Applications Ltd., West Lothian, UK; Alexander S. Narin'yani, Russian Research Institute of Artificial Intelligence, Moscow, Russia; Erik Sandewall, Linköping University, Sweden; Luc Steels, Free University of Brussels, Belgium; Harald Trost, University of Vienna, Austria; Bernard Zeigler, University of Arizona, Tucson, AZ, USA.

AIMS AND SCOPE: Applied Artificial Intelligence addresses concerns in applied research and applications of artificial intelligence (Al). The journal also acts as a medium for exchanging ideas and thoughts about impacts of AI research. Papers should highlight advances in uses of expert systems for solving tasks in management, industry, engineering, administration, and education; evaluations of existing AI systems and tools, emphasizing comparative studies and user experiences; and/or economic, social, and cultural impacts of AI. Information on key applications, highlighting methods, time-schedules, labor, and other relevant material is welcome.

Abstracted and/or Indexed in: Compumath Citation Index, Engineering Information, Inc., INSPEC, Research Alert, and SciSearch.

Editorial Office: Robert Trappl, Austrian Research Institute for Artificial Intelligence, Schottengasse 3, A- 1010, Vienna, Austria; and University of Vienna; E-mail: sec@ai.univie.ac.at

Publishing, Advertising, and Production Offices: Taylor & Francis, 1101 Vermont Ave., Suite 200, Washington, DC 20005, phone (202)289-2174, fax (202)289-3665, Christine E. Williams, Production Editor, or Taylor & Francis Ltd., Rankine Rd., Basingstoke, Hampshire RG24 0PR, UK. Subscriptions Office: 1900 Frost Rd., Suite 101, Bristol, PA 19007, phone (215)785-5800, fax (215)785-5515; or Taylor & Francis Ltd., Rankine Rd., Basingstoke, Hampshire RG24 0PR, UK, phone +44-256-840366, fax +44-256-479438.

Applied Artificial Intelligence (ISSN 0883-9514) is published quarterly by Taylor & Francis Ltd., 4 John Street, London WCIN 2ET UK. Annual 1994 institutional subscritus UK £135, US \$228. Personal subscription rate UK £68, US \$109; available to home address only and must be paid for by nersonal check or credit card.

Second-class postage paid at Jamaica, NY 11431. U.S. Postmaster: Send address changes to Applied Artificial Intelligence, Publications Expediting Inc., 200 Meacham Avenue, Elmont, NY 11003.

Dollar rates apply to subscribers in all countries except the UK and the Republic of Ireland, where the sterling price applies. All subscriptions are payable in advance and all rates include postage. Subscriptions are entered on an annual basis, i.e., January to December. Payment may be made by sterling check, dollar check, international money order, National Giro, or credit card (AMEX, VISA, Mastercard/ Access).

Orders originating in the following territories should be sent directly to: Australia—R. Hill & Son, Ltd., Suite 2, 119 Gardenvale Road, Gardenvale, Victoria, Australia 3185. India—Universal Subscription Agency Pvt. Ltd., 101-102 Community Centre, Malviya Nagar Extn., Post Bag No. 8, Saket, New Delhi. Japan—Kinokuniya Company, Ltd., Journal Department, P.O. Box 55, Chitose, Tokyo 156. New Zealand—R. Hill & Son, Ltd., Private Bag, Newmarket, Auckland 1. USA, Canada, and Mexico—Taylor & Francis, 1900 Frost Road, Suite 101, Bristol, PA 19007, USA. UK and all other territories—Taylor & Francis Ltd., Rankine Road, Basingstoke, Hampshire, RG24 0PR, England.

Copyright © 1994 Taylor & Francis. All rights reserved. Authors are responsible for obtaining permission to reproduce copyrighted material from other sources and are required to sign an agreement for the transfer of copyright to the publisher. Printed in the United States of America. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by Taylor & Francis for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$10.00 per copy, plus. 00 per page is paid diretly to CCC, 27 Congress St., Salem, MA 01970, USA.

The publisher assumes no responsibility for any statements of fact or opinion expressed in the published papers. The appearance of advertising in this journal does not constitute an endorsement or approval by the publisher, the editor, or the editorial board of the quality or value of the product advertised or of the claims made for it by its manufacturer. Applied Artificial Intelligence is owned by Taylor & Francis.

Printed on acid-free paper, effective with Volume 5, Number 4, 1991.

CONTENTS TO VOLUME 8

NUMBER 1

Special Issue Real World Applications of Machine Learning Part 1

Guest Editor: Yves Kodratoff

iii	LETTER FROM THE EDITOR
v	FOREWORD
1	CAN MACHINE LEARNING SOLVE MY PROBLEM? ☐ Yves Kodratoff, Vassilis Moustakis, and Nicolas Graner
33	MULTISTRATEGY LEARNING FOR DOCUMENT RECOGNITION Floriana Esposito, Donato Malerba, and Giovanni Semeraro
85	LEFT—A SYSTEM THAT LEARNS RULES ABOUT VLSI DESIGN FROM STRUCTURAL DESCRIPTIONS Jürgen Herrmann and Renate Beckmann
109	MACHINE LEARNING IN TRANSPORTATION ENGINEERING: A FEASIBILITY STUDY T. Arciszewski, S. Khasnabis, S. Khurshidul Hoda, and W. Ziarko
125	REPRESENTATION DESIGN AND BRUTE-FORCE INDUCTION IN A BOEING MANUFACTURING DOMAIN Patricia Riddle, Richard Segal, and Oren Etzioni
149	FACE RECOGNITION THROUGH LEARNED BOUNDARY CHARACTERISTICS L. Spacek, M. Kubat, and D. Flotzinger
165	ANNOUNCEMENT

Special Issue Function-Based Reasoning Part 1

Guest Editor: Jon Sticklen

167	FUNCTION-BASED REASONING: AN INTRODUCTION Amruth N. Kumar
173	FUNCTIONAL REPRESENTATION: A BRIEF HISTORICAL PERSPECTIVE B. Chandrasekaran
199	THE WHAT, THE HOW, AND THE WHY IN DESIGN $\ \square$ M. A. Rosenman and J. S. Gero
219	FUNCTIONAL MODELS IN PERSPECTIVE: THEIR CHARACTERISTICS AND INTEGRATION IN MULTIPLE MODEL-BASED DIAGNOSIS Ameen Abu-Hanna, Wouter Jansweijer, Richard Benjamins, and Bob Wielinga
239	PUTTING FUNCTIONAL KNOWLEDGE ON FIRMER GROUND Luca Chittaro, Carlo Tasso, and Elio Toppano
259	MODELING GOALS AND FUNCTIONS OF COMPLEX INDUSTRIAL PLANTS Morten Lind
285	FUNCTION-BASED MODELING AND TROUBLESHOOTING Robert Hawkins, Jon STicklen, James K. McDowell, Tim Hill, and Roger Boyer
303	BOOK REVIEW
305	ANNOUNCEMENT
NUM	BER 3
iii	OBITUARY
v	ACKNOWLEDGMENT
307	QUALITATIVELY MODELING PHOTOSYNTHESIS John E. Hunt and Denise E. Cooke
333	MRG: BUILDING PLANNERS FOR REAL-WORLD COMPLEX APPLICATIONS ☐ Paolo Traverso, Alessandro Cimatti, Luca Spalazzi, Alessandro Armando, and Enrico Giunchiglia

CASE-BASED REASONING IN ENVIRONMENTAL MONITORING 359 APPLICATIONS
Georgios P. Lekkas, Nicholas M. Avouris, and Loizos G. Viras ARTIFICIAL INTELLIGENCE IN SCHEDULING AND INSTRUCTION 377 SELECTION FOR DIGITAL SIGNAL PROCESSORS
Kin H. Yu and Yu Hen Hu DESIGNING COMPLEX SYSTEMS WITHIN DISTRIBUTED 393 ARCHITECTURES: AN INTELLIGENT TUTORING SYSTEMS PERSPECTIVE Antonio Gisolfi and Vincenzo Loia IMPROVING THE SCOPE OF INTELLIGENT TUTORING BY 413 ADAPTING A CASE-BASED METHODOLOGY THROUGH A DISTRIBUTED ARCHITECTURE | Juan E. Vargas and Chang Jin Kee SEMANTIC ANALYSIS AND IN-DEPTH UNDERSTANDING OF 425 TECHNICAL TEXTS

Marc Cavazza and Pierre Zweigenbaum 455 **BOOKS RECEIVED** 457 **ANNOUNCEMENTS NUMBER 4** Special Issue **Real World Applications of Machine Learning** Part 2 **Guest Editor:** Yves Kodratoff EXPLANATION-BASED NATURAL LANGUAGE ACQUISITION USING 459 UNIVERSAL LINGUISTIC PRINCIPLES AS INNATE DOMAIN THEORY

Rey-long Liu and Von-Wun Soo 483 REINFORCEMENT LEARNING OR TRACKING OF INPUT-OUTPUT MAPS ☐ Michael Heiss INDUSTRIAL EXPERT SYSTEM ACQUIRED BY MACHINE LEARNING 497 ☐ Mouna el Attar and Xavier Hamery 543 FIELDED MACHINE LEARNING SYSTEM FOR VOCATIONAL COUNSELLING

Harald Kjellin and Magnus Boman ANALYZING FRENCH JUSTICE WITH A GENETIC-BASED INDUCTIVE 565 ALGORITHM

Gilles Venturini KNOWLEDGEABLE LEARNING USING MOBAL: A MEDICAL CASE 579 STUDY

K. Morik, G. Potamias, V. S. Moustakis, and G. Charissis

593	MACHINE LEARNING GOES TO THE BANK Claire Nedellec, Joaquim Correia, José Luis Ferreira, and Ernesto Costa
617	XPLANS: CASE-BASED REASONING FOR PLAN RECOGNITION Michel Barès, Dolores Cañamero, Jean-Franécois Delannoy, and Yves Kodratoff
645	OPTIMIZING AN AIR DEFENSE EVALUATION MODEL USING INDUCTIVE LEARNING Yuh-jeng Lee and Chang-yun Lo

